ER65

ELECTRICAL WORKERS REGISTRATION BOARD

SAFETY | COMPETENCY | COMPLIANCE

Candidate Code No.	
For Board Use Only	
Result	Result
Date	Date
Int	Int

ELECTRICIANS REGULATIONS EXAMINATION

27 June 2015

QUESTION AND ANSWER BOOKLET

Time Allowed: Three hours

INSTRUCTIONS – READ CAREFULLY

You have 10 minutes to read this paper but do not start writing until you are told to do so by the supervisor.

Write your Candidate Code Number in the box provided above. Your name must NOT appear anywhere in this paper.

Answer all questions.

The pass mark for this examination is 60 marks.

Use a pen for written answers. **Do not** use pencils or red pens.

Drawing instruments and pencils may be used when diagrams are required. Marks are allocated on the basis of correctness.

Do not use correcting fluid or correcting tape.

It is recommended that the reference source for your answers be included in the space provided if a question can be answered from the Act, Regulations, Standard or Code of Practice. However, just stating a reference only will earn no marks.

For calculation questions all workings, including formulae, must be shown to gain full marks.

Warning – You could get 0 marks for any question, or part of a question, if you show anything hazardous or dangerous in your answer.

You will need to use the following documents in this examination:

- Electricity (Safety) Regulations 2010 reprint dated 1 February 2014 or the reprint dated 1 August 2014
- AS/NZS 3000:2007 (incorporating amendments 1 and 2)
- NZECP 34

PLEASE HAND THIS PAPER TO THE SUPERVISOR BEFORE LEAVING THE ROOM

(turn over)

Question 1

(a) Refer to AS/NZS 3000 and state **TWO** situations where RCD protection shall be provided in a **new domestic electrical installation**.

(2 marks)

(1) ____

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(2) ____

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Ref: ....

(b) (i) Refer to AS/NZS 3000 and state the circumstances in which a main switchboard **can be** installed in an area that may be affected by water splashing or by steam.

(1 mark)

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Ref: ....

(ii) Refer to AS/NZS 3000 and state the circumstances in which a main switchboard **can be** installed in a sanitisation or hosing-down area

(1 mark)

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Ref: ....

(turn over)

Question 1 continued

(c) Refer to AS/NZS 3000 and calculate the minimum voltage permitted at the terminals of a single-phase industrial hot water cylinder that is 12 metres from the switchboard.

(2 marks)

Ref: ....

(d) A 25 mm^2 twin and earth PVC insulated, PVC sheathed cable is to installed underground between a point of supply and a building

Refer to AS/NZS 3000 and answer the following:

(i) State **ONE** installation category that can be used

(1 mark)

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Ref: ....

(ii) For the category stated in (d)(i), state the minimum depth the cable must be buried if there is no concrete on the surface.

(½ mark)

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Ref: ....

(iii) For the category stated in (d)(i), state the minimum depth the cable must be buried if 90 mm of continuous concrete will be poured on the surface.

(½ mark)

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Ref: ....

(turn over)

Question 1 continued

(e) A $4mm^2$ submain cable is to be run between two buildings.

Refer to AS/NZS 3000 and state **TWO** types of cable that can be buried direct in the ground without mechanical protection.

(2 marks)

(1) ____

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(2) ____

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Ref: ....

(f) Refer to AS/NZS 3000 and state **TWO** types of fittings that must form part of the protective earthing arrangements for an electrical installation connected to an MEN system

(2 marks)

(1) ____

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(2) ____

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Ref: ....

(turn over)

Question 1 continued

(g) Refer to AS/NZS 3000 and state **ONE** **supply** requirement which can apply to a **230V** socket outlet installed within Zone 3 of a shower in a domestic bathroom.

(2 marks)

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Ref: ……………………………………….

(h) Refer to AS/NZS 3000 and state **ONE** requirement relating to the discrimination of circuit protective devices where **safety services** are installed in an electrical installation.

(2 marks)

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Ref: …………………………………….

(turn over)

Question 1 continued

(i) Refer to AS/NZS 3000 and state the main difference between a PELV circuit and a SELV circuit.

(2 marks)

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Ref: ....

(j) (i) Refer to NZECP 34 and state the minimum approach distance limit for a **non-competent person** working near an 11,000V overhead electric line.

(1 mark)

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Ref: ....

(ii) Refer to NZECP 34 and state the minimum approach distance limit for a **competent person** working near an 11,000V overhead electric line.

(1 mark)

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Ref: ....

(turn over)

Question 2

Introduction

You have completed wiring work on a building in a commercial development. This work included:

Item Number	
1	New consumers mains from a new point of supply.
2	A new MEN main switchboard that has a higher current rating than the original.
3	Three new final subcircuits.
4	Replacing existing final subcircuits with conductors of the same size.
5	A new sub-main to a new storage building.
6	A new distribution switchboard in the new storage building.
7	New final subcircuits in the new storage building.
8	Replacing fluorescent light fittings with new fittings of the same rating as the original

The work has been installed in accordance with Part 2 of AS/NZS 3000.

Use the information in the introduction to this question to answer parts 2(a), 2(b) and 2(c).

(a) Which section of which document details the testing and inspection requirements for the work carried out?

(1 mark)

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(b) Refer to the Electricity (Safety) Regulations 2010 and answer the following:

(4 marks)

(i) Which of the work stated in the introduction is **low risk** prescribed electrical work? (State the relevant item numbers).

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Ref: ....

(turn over)

Question 2 continued

(ii) Which of the work stated in the introduction is **general risk** prescribed electrical work? (State the relevant item numbers).

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Ref: ....

(iii) Which of the work stated in the introduction is **high risk** prescribed electrical work? (State the relevant item numbers).

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Ref: ....

(c) (i) Which of the work stated in the introduction **must** be certified on a certificate of compliance? (State the relevant item numbers).

(3 marks)

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Ref: ....

(ii) Who is responsible for completing the certificate of compliance?

(1 mark)

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Ref: ....

(turn over)

Question 2 continued

(iii) Who is responsible for issuing the completed certificate of compliance to the person who contracted for the work?

(1 mark)

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Ref: ....

(turn over)

Question 3

You are wiring a combined office/shop (**A NON-DOMESTIC ELECTRICAL INSTALLATION**) which is part of a larger development. You need to assess the maximum demand of the installation to determine the size of the sub main cable that will supply the office/shop

The office/showroom is a single-phase, 230V electrical installation with the following loads:

8	60W lights
10	250W outside flood lights
30	8W LED lights
16	Metres of lighting track
10	10A single socket outlets
1	Gas water heater with controls supplied from a single 10A socket outlet
10	10A double socket outlets
1	6kW input air conditioner

Refer to AS/NZS 3000 and calculate maximum demand in amps of the office/showroom.

Use the table on the following page for your calculations.

(10 marks)

(turn over)

Question 3 continued

Equipment	Load Group	Calculation	Load (A)
Total			

Ref: ....

(turn over)

Question 4

(a) A single-phase, 230V, 4.5kW water heater is installed in a low voltage electrical installation.

(i) Refer to AS/NZS 3000 and state **ONE** general requirement for water heaters.

(2 marks)

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Ref: ....

(ii) Refer to AS/NZS 3000 and state the **THREE** isolation requirements for the water heater.

(3 marks)

(1) ____

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(2) ____

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(3) ____

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Ref: ....

(turn over)

Question 4 continued

(b) A capacitor is controlled by a circuit breaker.

Refer to AS/NZS 3000 and state the current–carrying capacity of the final subcircuit conductors that are connected to the capacitor.

(2 marks)

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Ref: ....

(c) A capacitor is permanently-connected in a motor circuit for power factor correction.

Refer to AS/NZS 3000 and state the current–carrying capacity of the supply conductors of the motor circuit.

(2 marks)

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Ref: ....

(d) Refer to AS/NZS 3000 and state the maximum rating of a motor that does not require protection against overload.

(1 mark)

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Ref: ....

(turn over)

Question 5

Electrical installations shall be provided with devices for isolation and switching to prevent or remove hazards associated with the electrical installation and for maintenance of electrical equipment.

(a) Refer to AS/NZS 3000 and state:

(i) The **common requirement** for preventing electrical equipment from being inadvertently energized.

(1 mark)

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Ref: ....

(ii) The **common requirement** where an enclosure contains more than one electricity supply.

(1 mark)

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Ref: ....

(turn over)

Question 5 continued

(b) Refer to AS/NZS 3000 and state **TWO** types of fittings or circuits that need not be controlled by a main switch.

(2 marks)

(1) ____

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(2) ____

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Ref: ....

(c) Refer to AS/NZS 3000 and state the requirements for the number of main switches in domestic electrical installations.

(3 marks)

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Ref: ....

(turn over)

Question 5 continued

(d) Refer to AS/NZS 3000 and state the circumstances where **functional switching** is permissible.

(1 mark)

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Ref: ....

(e) Refer to AS/NZS 3000 and state **ONE** situation where the switching of a neutral conductor is prohibited.

(2 marks)

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Ref: ....

(turn over)

Question 6

Introduction

Work is being carried at an apartment complex that involves:

- The wiring of new apartments
- Alteration and additions to the wiring in the existing apartments
- Alteration and additions to the complex common areas

Use the information in the introduction to this question to answer parts 6(a), 6(b), and 6(c).

(a) Refer to AS/NZS 3000 and state the **THREE** requirements for RCD protection of final subcircuits in the new apartments.

(3 marks)

(1) ____

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(2) ____

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(3) ____

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Ref: ....

(b) One of the apartments is to be changed to become a child day-care centre.

(i) Refer to AS/NZS 3000 and state the change that needs to be made to the RCD protection on the apartment (child-care centre) switchboard

(1 mark)

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Ref: ....

(turn over)

Question 6 continued

(ii) Refer to the Electricity (Safety) Regulations 2010 and state **THREE** characteristics of an RCD that provides protection for socket outlets in a child day-care centre.

(3 marks)

(1) ____

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(2) ____

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(3) ____

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Ref: ……………………………………

(turn over)

Question 6 continued

(c) (i) Refer to AS/NZS 3000 and state the circumstances under which cooking appliances supplied by socket outlets in the new apartments are not required to have RCD protection.

(2 marks)

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Ref: ....

(ii) State **ONE** technical reason why you would not install RCD protection for a cooking appliance.

(1 mark)

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(turn over)

Question 7

(a) In a **new domestic installation**, conductor insulation colour is used as means of the identification. Refer to the Electrical (Safety) Regulations 2010 and state the **TWO** requirements for the colour of the neutral conductors of the fixed wiring.

(2 marks)

(1) ____

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(2) ____

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Ref: ....

(b) Refer to AS/NZS 3000 and state **TWO** requirements for the use of green/yellow conductors in installation wiring in an electrical installation.

(2 marks)

(1) ____

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(2) ____

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Ref: ....

(turn over)

Question 7 continued

(c) Refer to AS/NZS 3000 and state the **THREE** circumstances where active or neutral conductors need not be identified by colour in accordance with Table 3.4.

(3 marks)

(1) ____

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(2) ____

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(3) ____

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Ref: ....

(d) Refer to AS/NZS 3000 and state the prohibition relating to installing wiring systems under wall linings or roofing material.

(1 mark)

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Ref: ....

(turn over)

Question 7 continued

(e) AS/NZS 3000 permits a common neutral conductor to be used for two or more final subcircuits.

Refer to AS/NZS 3000 and state **ONE** situation where three, **single-phase final subcircuits** can share a common neutral.

(2 marks)

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Ref: ....

(turn over)

Question 8

(a) (i) For which type of protective device is the term **tripping factor** used.
(1 mark)

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(ii) Define the term **tripping factor**.
(1 mark)

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(b) State **TWO** reasons why it is important to consider the prospective-short-circuit current rating when selecting a protective device for an electrical installation.
(2 marks)

(1) ____

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(2) ____

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(c) In low voltage, MEN a.c. systems protection devices are required to operate when touch voltages exceed a pre-determined level.

Refer to AS/NZS 3000 and state the maximum a.c. touch voltage permitted before a protective device is required to operate.
(1 mark)

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Ref: ....

(turn over)

Question 8 continued

(d) Refer to AS/NZS 3000 and state the **TWO** characteristics required of short-circuit protective devices.

(2 marks)

(1) ____

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(2) ____

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Ref: ....

(e) In low voltage MEN a.c. systems, protection devices that protect 230 volt circuits and final sub circuits must operate within maximum disconnection times. Refer to AS/NZS 3000 and state **TWO** types of 230V circuits and the maximum disconnection time for each.

(2 marks)

(1) ____

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(2) ____

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Ref: ....

(turn over)

Question 8 continued

(f) Refer to AS/NZS 3000 and state the characteristic of a device that provides protection for both overload and short-circuit currents.

(1 mark)

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Ref: ……………………………………….

(turn over)

Question 9

Sound earthing arrangements are fundamental to the safety of an MEN (TNCS) system of supply.

(a) Equipotential bonding

(i) Refer to AS/NZS 3000 and state the **primary** reason why equipotential bonding is carried out in a low voltage electrical installation.

(2 marks)

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Ref: ………………………………….

(ii) Refer to AS/NZS 3000 and state the minimum size of equipotential bonding conductor for conductive or metallic piping that must be installed in a low voltage electrical installation if the largest active conductor is 35mm^2 Cu.

(1 mark)

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Ref: ………………………………….

(iii) Refer to AS/NZS 3000 and state **ONE** reason why the minimum size of equipotential bonding conductor stated in (a)(ii) may need to be increased.

(1 mark)

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Ref: ………………………………….

(turn over)

Question 9 continued

(iv) Refer to AS/NZS 3000 and state the reason why the conducive reinforcing in the floor of a room containing a bath or a shower shall be bonded to the earthing system of the electrical installation.

(1 mark)

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Ref: …………………………………..

(b) Earthing of electrical equipment

(i) Refer to AS/NZS 3000 and state the specific circumstances where the **metallic or conductive sheath of a cable in a wiring system** need not be earthed.

(3 marks)

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Ref: …………………………………..

(turn over)

Question 9 continued

(ii) Refer to AS/NZS 3000 and state the **FOUR** types of lighting points (luminaires) that **do not** require a protective earthing conductor.

(2 marks)

(1) ____

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(2) ____

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(3) ____

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(4) ____

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Ref: ……………………………………..

For Candidate's Use

In the box, write the number of **EXTRA** sheets you have used. Write **NIL** if you have not used any

For Examiner's Use Only

Questions Answered	Marks	
1		
2		
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7		
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TOTAL		